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N. D. C. HODGES,

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SCIENCE

NEW YORK, FEBRUARY 10, 1893.

THE ICE-WALL ON THE BEACH AT HULL, MASSACHUSETTS, JANUARY, 1893.

BY J. B. WOODWORTH, SOMERVILLE, MASS.

THE exceptionally long-continued cold of the early part of January, this year, favored the development of a considerable wall of coast-ice on the long barrier beach connecting the rocky headland of Nantasket with Strawberry Hill and the neighboring drumlin at Point Allerton at the entrance to Boston Harbor. At the same time, the embayed waters of Boston Harbor froze over. I visited the beach at Hull on the 24th of the month, at a time the temperature had risen above the freezing point, and when the sheet-ice had left the shore and was only visible as cakes floating near the horizon.

At Nantasket, from the vicinity of the cafes northward to near Point Allerton, the ice-wall formed a rampart near high-tide mark of triangular cross-section, having an average elevation of about 8 feet and a breadth of base of 20 feet. The seaward slope of this wall was shorter and steeper than the landward, and was also much more irregular, owing to the action of the waves and some melting. The landward slope merged into the sheet of snow back of the beach. The accompanying diagram will make clearer this description.

FIG. 1. — General cross-section of the ice-wall at Hull.

The wall was composed in part of cakes, but in larger measure of granular ice, making the whole a compact mass, whose front was broken at frequent intervals by recesses swept by the waves at high tide. The beginnings of these recesses were seen in numerous caverns at the bottom of the ice, some of which were large enough to permit a man to crawl under the arch, and in one case a breach had been made through to the beach in the rear of the wall. In another instance, where the crest of the wall was low, the arch was fissured, as shown in Fig. 2, apparently by the pressure of waves in passing through the tunnel.

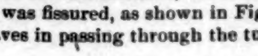

FIG. 2. — Ice-arch fissured by wave-action.

From many of the small caves little streams were trickling out over the sand beach in front. These streams were busily employed at low tide in building and re-arranging small deltas of fine sand, a long stretch of which lay between high and low tide-marks.

The drainage of water produced by the superficial melting of the ice at mid-day was mainly in the form of drops from the protuberant masses one or two feet above the base, which was slightly receding, a feature determined by the water at high tide. These drops of water fell upon the wet sand of the beach and made well-marked pits, the cross-sections of some of which are shown in the adjoined Fig. 3. These pits were distributed along the front of the ice-wall just under the high-tide limit.

Some of these depressions resemble the so-called rain-drop imprints on the older strata, and serve to make us cautious in the interpretation of such markings. I have also seen the spray from surf, as on the beach at Gay Head, Mass., make similar impressions. The larger impressions at Hull were as much as three inches in diameter, but correspondingly shallow, while those which were in process of formation were not over half an inch across and half an inch deep. Around each pit, into which water was dropping, a rim of sand was raised. The larger pits, just described, were, except for what I am about to describe, without any signs of the cause of their formation. In several instances, however, I observed that water was dropping in a narrow, deep pit, formed exactly in the centre of one of the large shallow ones.

FIG. 3. — Pits made on the beach by water dripping from coast-ice. *a*. Deep and narrow pit. *b*. Broad, shallow pit. *c*. Renovated pit.

The explanation of these pits seems to be this, that, after the dropping has ceased for a time, as by the freezing of the surface of the ice-wall at night, the sands about the deep pits cave in, being highly mobile by reason of the water they contain. If now, on the next period of melting, drops of water drip from the same icicle-like projection of the ice-wall, a new, deep, but narrow pit will form in the place held by the old one. The geological interest of these pits is evident when we compare them with some of the pit-like depressions found in the Cambrian and other deposits of beach origin. The surface of the arenaceous slates of presumably Lower Cambrian age in Somerville, Mass., are marked with pits closely resembling many of these made by water falling from coast-ice. In fact, it would be difficult to distinguish them from the so-called genus of worm-burrows, Monocraterion, where the long tube penetrating the sand is obscure or wanting.

The strength of the waves applied to the face of this wall of ice can be estimated from the fact that a whale, about 40 feet long (*Physeter macrocephalus*), had been washed ashore abreast of Strawberry Hill, and lay with his head to the north, close up to the foot of the wall of ice, apparently in a position determined by the run of the shore-current during a "north-easter." The depth of water necessary to float this body in was in part obtained through the backing-up of the waves against the wall of ice. The effect of this action on the regimen of the beach was better shown on the bouldery pavement near Point Allerton.

Under the ordinary summer conditions of this beach, the swash of the surf advances up it as a thin sheet of foaming water, halts for an instant, and then recedes, to be overtaken by another wave. The ice-wall, however, at high-tide mark, or just below it, interferes with the action of the swash. The result is that the water is held up against the ice-wall, and when it recedes goes out as a deeper sheet than when the wave has a chance to run up the beach and spread out as a thin layer of water. This thin sheet of water cannot move the larger boulders except by removing the finer materials from their bases, but the thick sheet in front of the ice-wall acts more potently on the larger cobbles and boulders, dragging them up and down the beach, so that its aspect is for the time quite altered. To this action must be added the effect of cakes of ice, with inter-stratified layers of sand and gravel and occasionally included cobbles, which are left pell-mell on the beach with the receding tide.

The larger beach pebbles, which have been reduced to the form of wear characteristic of their class, exhibit an interesting fact which should be noticed here. During the season of minimum wave-action, the pebbles are smoothed by attrition with the finer gravels and sands, which are alone in movement; but in the winter, during heavy storms, the pebbles and cobbles are dashed together, and their smooth surfaces scarred with dents. In the case of an elongate cylindrical pebble, it was very apparent from

the grayish pulverulent appearance of the extremities that the wear was greater on the ends than on the sides, though it should be remarked that this pebble was probably thrown sideways quite as frequently, if not more frequently, than endwise against its neighbors.

THE GENERIC EVOLUTION OF THE PALÆOZOIC BRACHIOPODA.

BY AGNES CRANE, BRIGHTON, ENGLAND.

IT is a time-honored saying that "a prophet is not without honor save in his own country," but the name and fame of Professor James Hall, LL.D., director of the State Museum of Natural History of New York, and its veteran State geologist, are well known in Canada and the United States and have long been recognized and appreciated among the geologists and invertebrate palæontologists of Europe. The highest recognition in geological circles was accorded him nearly a quarter of a century ago, when he was awarded the Wollaston Medal of the Geological Society of London, the year after Barrande, and a year before Charles Darwin received it. His arduous life-long researches have resulted in the production of the fine series of monographs of "The Palæontology of New York," of which Vol. VIII., Part I., Brachiopoda,[1] by James Hall, assisted by John M. Clarke, has recently made its appearance, with an unusually interesting text and the well-executed plates for which the series has been remarkable. As a fossil brachiopodist Professor Hall ranks with his eminent contemporaries, the late Dr. Thomas Davidson, F.R.S., and Joachim Barrande of Prague. In one respect he may be said to take higher position as a philosophical investigator, inasmuch that he kept free from prejudice with regard to the theory of evolution as applied to the class Brachiopoda at a time when, owing to the condition of our knowledge of the group, it was not possible to adduce actual proofs of the logical postulate in that direction.

Times and methods have changed indeed since the celebrated Bohemian palæontologist definitely proclaimed that the evidence of the Cephalopoda[2] and of the Brachiopoda[3] was opposed to the truth of the theory of evolution, and Dr. Davidson, in answer to a personal appeal from Darwin, replied that he was unable to detect direct evidence of the passage of one genus into another.[4]

There has been a marked advance in the philosophical treatment of this important group of ancient and persistent organisms during the last decade, and to this progress American scientists have contributed largely. Mr. W. H. Dall has differentiated and described some new genera and species of the recent forms of interest and value. Professors Morse, Brooks, and Beyer, and of late Dr. Beecher and Mr. Clarke, have revealed suggestive phases in the developmental history of typical genera and well-known species. Now Professor James Hall and Mr. J. M. Clarke have sifted and compared the vast accumulations of data recorded by earlier writers by the older methods of descriptive palæontology, and, combining the results thus gained with the best features of the new school of investigators, have effected a revolution in the general treatment of the entire class of Brachiopoda. They trace important stages in the phylogeny of the fossil forms and various links connecting them through their immediate successors with the surviving members of the group.

Much of this work could not possibly have been accomplished had it not been for the mass of descriptions and figures of the vast number of species recorded in the works of Barrande, Davidson, De Koninck, D'Orbigny, Defrance, Deslongchamps, Suess, Lindstrom, Pander, Quenstedt, Geinitz, Littell, Oppel, Oehlert, Waagen, and Neumayr, in Europe, and Billings, Hall, Clarke, Meek, Shumard, Worthen, Walcott, White, Whitfield, and others on the continent of America.

The warm and discriminating recognition of the valued labors of his European fellow-workers is one of the most agreeable features of Professor Hall's new volume. It is pleasant to read "of the greatest of all works on the Brachiopoda by Thomas Davidson," of the just appreciation of Barrande's herculean efforts in the Silurian field, of the excellence of William King's anatomical investigations, to find Pander's early work valued and his names restored. These are just and generous tributes to the memory of comrades who have gone before most welcome in these latter days of that strident "individualism" which is often mere egotism in disguise.

The New York palæontologist's recent work is not only a critical *résumé* with descriptions and figures of the Brachiopoda of New York, but a careful analysis of the results of the labors of his predecessors and contemporaries in the same extended palæozoic field of research in the United States, Canada, Russia, Sweden, and Great Britain. This gives it a cosmopolitan value, and affords opportunity, by means of critical comparisons of genera, species, and varieties from the geological horizons of both hemispheres, to recognize the identity of species, to define synonyms, to collate genera and sub-genera, to indicate their inter-relationships, and to illustrate the passage-forms linking one group, or assemblage of allied genera, to another. To this branch of the subject we must now restrict our observations.

With singular modesty the authors refrain, for the present, from proposing any new scheme of classification. The primary division of the class into two orders comprising the non-articulated and articulated genera is adopted. We fail to see why Owen's names of *Lyopomata*, or "loose valves," and *Arthropomata*, or "jointed valves," should have been discarded, for they define the same limits and distinctions as Huxley's simpler, but later, names, *Articulata* and *Inarticulata*, the first of which was employed by Deshayes to designate certain forms of Brachiopoda before the publicatian of Huxley's "Introduction to the Classification of Animals." In England it is generally conceded that the priority and scope of Owen's orders were clearly established by the American systematist, Dr. Theodore Gill. The matter, however, is of less moment now that a general tendency to admit greater ordinal sub-division has arisen. Waagen has proposed six orders, Neumayr eight, and Beecher four, based on the peduncular opening and associated characters.

The names *Inarticulata* and *Articulata* express certain general distinctions. Nevertheless, it is a matter of fact that forms have often appeared which cannot be separated thus, for tendencies to transgress these artificial limits become apparent in various directions. For instance, the species of the Silurian genus *Trimerella* was shown by Davidson and King to be but feebly articulated, and now *Neobolus*, *Spondylobolus*, and Hall's new linguloid genus, *Barroisella*, are shown to exhibit the same propensity. We are glad to note that, although fifteen years have elapsed since the publication of the Memoir on the *Trimerellidæ*, by Thomas Davidson and William King,[5] it is frankly admitted that later observations have hitherto added comparatively little to the results achieved by those eminent investigators and have taken away nothing from their value.

In the present publication the semi-artificial, but convenient, family designations are not adopted, but the genera discussed fall into groups of associated genera, often exhibiting intermediate characters, which link one genus naturally with another. More has been accomplished in this direction than could possibly have been anticipated, and the eighth volume of the Geological Survey of the State of New York (Palæontology) would have made glad the heart of Darwin, for its dominant note is the evolution of genera.

Hitherto *Lingula* has always been regarded as taxonomically at the base of the Brachiopoda in spite of the acknowledged complexity of its muscular system and the date of its appearance in the geological series. It is now shown conclusively to be developed from an obolelloid type which culminated in a faunal epoch anterior to the appearance of *Lingula*, and Brook's history of the development of the living species is cited as confirmatory proof

[1] Natural History of New York. Palæontology, vol. viii. (Geological Survey of the State of New York), "An Introduction to the Study of the Genera of Palæozoic Brachiopoda." Part. I. By James Hall, State Geologist and Palæontologist, assisted by John M. Clarke. Albany, 1892.

[2] Cephalopodes, Etudes Générales par Joachim Barrande, Prague, 1877, p. 224.

[3] Brachiopodes, Etudes Locales, *Ibid*, 1879, p. 206.

[4] "What is a Brachiopod?" by Thomas Davidson, F.R.S., Geological Magazine, Decade II., vol. iv., 1877.

[5] Quarterly Journal of the Geological Society of London, vol. xxx., p. 124, 1874.

of the direct obolelloid derivation of the palæozoic *Linguloe* from *Obolella*. *Lingulella* and *Lingulepis*, forerunners of *Lingula*, may be found to be important connecting links, having the outward form of linguloids with the muscular arrangements and narrow pedicle slit of the obolelloids. "The development on the linguloid line has continued, as we believe, from early Silurian to the present time with frequent modifications. From *Lingula* we may depart in many directions. In *Lingulops* and *Lingulasma* we get indications of physiological influences on the origin of genera."

It appears that "augmented muscular energy and concomitant increased secretion of muscular fulcra" with the large size and consequent displacement of the liver induced the thickening of the entire area of muscular implantation. Gradual excavation of this solid plate ensued, and the formation of a more or less vaulted platform, extremely developed, in the feebly articulated Trimerellids of those Silurian seas, which favored the rapid development of the platform-bearing Brachiopoda, a race which was abruptly exterminated at the close of the Niagara and Wenlock period. Hall's new genus, *Barroisella*, is a divergent so marked by the development of deltidial callosities as to indicate their approximating specialization for articulating and interlocking purposes. Thus we get most striking evidence of a tendency to span the interval between the so-called edentulous *Inarticulata* and the articulated genera in the Linguloid and Trimerelloid groups.

The genus *Obolus* is shown to be more specialized than *Obolella*, less so than *Lingula*, *Neobolus* being an intermediate form with cardinal processes, also indicative of progress in this direction towards the *Articulata*. In *Obolus*, however, the muscular scars are excavated as in *Lingula*, not elevated as in the forms tending to *Trimerella*. Thus we get indications in the history of the ancestral Trimerellids of the attainment of a like remarkable resultant along distinct lines of development, of which another instance has been furnished by Messrs. Fischer and Oehlert's recent studies of the development of the living *Magellanœ* of the boreal and austral oceans, to which we had elsewhere occasion to refer.[1] As Hall and Clarke's generalizations are formulated with a due regard to geological sequence, they possess more validity than the phylogenetic deductions enunciated by a Teutonic palæontologist, in which that important factor was somewhat neglected.[2] "We have yet to seek," the American brachiopodists conclude, "the source whence these numerous closely allied primoidial groups are derived, in some earlier comprehensive stock of which we have yet no knowledge. The ages preceding the Silurian afforded abundant time for a tendency to variability to express itself" (p. 168).

From this satisfactory discussion of the origin and development of the palæozoic unarticulated genera and species, Hall and Clarke proceed to consider the structure and relations of the far more numerous and more complicated order of the articulated species, and commence with the Orthoids, the lowest forms of the Articulata, as, by common consent, they are now regarded. The allied Strophomenoid, Streptorhynchoid, and Leptaenoids, as defined by Dalman, are then treated of and the first part terminates with a discussion of some carboniferous Productoids. The spire-bearers, Rhynchonelloids and Terebratuloids, of the Palæozoic seas are thus left for the concluding volume, when we may look for a valuable general summary of results and for that systematic classification, based on their completed investigations, which the authors are bound to propose in the interest of students for the root, stem, branches, and twigs of the genealogical tree of the Brachiopoda, as they have definitely abandoned the family names hitherto in vogue. It must certainly be admitted that brachiopodists have often found it difficult, and sometimes impossible, to determine to which of two well characterized families certain annectent forms should be definitely referred.

In Europe, however, the retention of family designations is not always considered incompatible with the modern philosophical and evolutional methods of class treatment. They have been preserved with advantage; for instance, in Mr. A. Smith Woodward's[3] masterly systematic classification of the fossil fishes in the British Museum, and also in Professor W. A. Herdman's[4] exhaustive report on the Tunicata dredged by the "Challenger" expedition, associated in this case with evolutional data and the presentation of numerous phylums showing the inter-relations of genera, somewhat after the same plan as that adopted in the "Introduction to the Study of the Palæozoic Genera of Brachiopoda." With all due respect to the veteran of the old school and the disciple of the new, we venture to submit the impossibility of impressing on the mental retina a permanent photograph of the innumerable and fascinating phylums which they have provided with such industrious research. But we are not all endowed with so much insight, knowledge, and experience.

The most revolutionary feature in the present instalment of their researches on the *Articulata* is the extreme sub-division to which the great group of Orthoids has been subjected. The genus *Orthis* is absolutely restricted to eight species (instead of two hundred), with *O. callactis* of Dalman as the type, and his early figures and original descriptions are judiciously reproduced for the benefit of American students. The remainder of the large number of species are placed under various new genera and subgenera, or restored to their former appellations. For instance, Pander's name, *Clitambonites*, is once more applied to species unjustly usurped by D'Orbigny's *Orthisina*, and *Plectambonites* of the same Russian palæontologist is restored for the Palæozoic species grouped by the French conchologists and those who followed them under the genus *Leptaena* of authors not of Dalman. The *Leptaena rugosa* of this author is taken as the type of his genus, the scope of which is thus much restricted, and new generic names are proposed for several of the species indifferently described as *Strophomenas* or *Leptaenas* by various authors. Linné's sub-genus *Bilobites* is revived for those abnormal bilobed species of *Orthis*, which, according to Dr. Beecher's investigations, originated from a normal form at the adolescent and mature stages of growth in both direct and indirect lines of development. In view of the extensive breaking-up of the Orthoids, here proposed, into several genera and sub-genera, we are willing to confess that to object to the revival of *Bilobites* would be but straining at a gnat and swallowing the camel. We, however, admit a preference for those among the proposed new or restored designations which give some indications of the former position of the species among genera. Such are *Protorthis*, *Plectorthis*, *Heterorthis*, *Orthostrophia*, *Platystrophia*, and so on. *Orthidium* for the generic divergent nearest allied to *Strophomena* seems a less happy selection. Tabular views, both instructive and suggestive, are given to show the approximate range in the geological horizons from the calciferous shales of the Lower Silurian to the Upper Coal Measures which indicate the appearance, persistence, and extinction of the various genera into which, under new, old, or restored appellations, the Orthoids, Strophomenoids, and Leptaenoids are sub-divided — a sub-division which, with its associated shifting of types, will not escape criticism.

There will always be differences of opinion respecting generic values. Here, as Heckel long ago pointed out, the personal equation becomes prominent. We believe Professor Cope was the first to advance the then heterodox view that species could be transferred from one genus to another without affecting their specific characters. Many so termed genera represent what have now become abbreviated transitional phases in the development of the race which, of old time, became stereotyped for periods of longer or shorter geological duration. The researches of Friele and Oehlert on the recent Magellanæ (*Waldhumia*) the ultimate phase of development of the long-looped branch of the Terebratuloids, illustrate this point most clearly. If the inter-relationships and passages of these generic phases are carefully noted, they become so many illustrations of one method of the evolution of genera, which, sometimes, it is evident, originated from causes incidental to individual development, accelerated growth, and the circumstances of the environment.

[1] On the Distribution and Generic Evolution of Some Recent Brachiopoda, By Agnes Crane, Natural Science, January, 1893.

[2] Neumayr, "Die Stämme des Thierreichs Brachiopoda," 1890.

[3] A Catalogue of the Fossil Fishes in the British Museum, Part I., 1889; Part II., 1890.

[4] Reports of the "Challenger" Expedition: Tunicata, vols. vi., xiv., and xxvi.

Professor Hall evidently considers it better to deal with a small number of well-characterized species instead of a large number of ill-defined forms, and that such minor structural internal modifications as can be shown to be constant in a recognized geological horizon should be raised to generic or sub-generic rank. The description and portrayal of such generic divergencies afford the best means for general comparison and thus tend to promote a clearer comprehension of the manifold phases of the evolution of genera. The fact that specific characters sometimes make their appearance in individual development before generic features is most suggestive. For the laws of "science and growth,"[1] first made known by Heckel, and since extended by Hyatt to the *Cephalopoda*, Jackson to the *Pelycypoda*, and Beecher and Clarke to the Brachiopoda, the term auxology[2] has been lately proposed by English systematists, with some elucidative and etymological modifications in Hyatt's terminology. These principles govern individual and specific development of genera. For genera are stages in the life history of the race as distinguished from the genealogical records of the individual. It would seem, however, that just as the co-existence of a large number of individuals tends to perpetuate specific variation, so the simultaneous occurrence of abundance of species in one horizon and area is productive of the divergence of genera.

We cannot enter further into details; enough has been written to show beyond contradiction the value and interest of his "Introduction to the Study of the Genera of Palæozoic Brachiopoda," with its concise descriptions of genera and passage-forms, their inter-relations, and affiliated species. It is rendered complete by excellent specific bibliographies, well considered genealogical trees, showing the common ancestry, diverging lines of descent, and affinities of genera with their geological range, a register of genera and of species, authors' and general index. The work is most creditable to Professor James Hall and his assistant, Mr. J. M. Clarke, and reflects honor on America in general and the State of New York in particular. It deserves to be carefully studied by invertebrate biologists in both hemispheres. We trust the publication of the second part will be proceeded with, and that by its rapid completion, on similar lines of thought, science may be enriched by a general view of the evolution of the Brachiopoda. It is much to be desired that the relations of the secondary and tertiary species should be discussed in a like thorough, philosophical, and generally satisfactory manner.

We have become so convinced of the advantages of this method of treatment, that we have begun to form the nucleus of a collection in the Brighton Museum, destined to illustrate the evolution of genera among the Brachiopoda.

ON THE SO-CALLED INCAS EYES.

BY W. S. MILLER, UNIVERSITY OF WISCONSIN, MADISON, WIS.

AT the time of the earthquake and accompanying tidal-wave which swept over Arica, Peru, August 13, 1868, causing so much destruction of life, property, and shipping, the U. S. man-of-war "Kearsarge" was lying some two hundred miles down the coast. The shock there was comparatively slight to what it was at Arica. Word was received the following morning of the disaster up the coast, and the vessel left immediately to render such assistance as lay in its power. The history of that earthquake is well known. I will refer any who may wish to read an account of the occurrence to an article in *Harper's Monthly* for April, 1869. The late Lieutenant Gardner, U. S. N., was at that time stationed on the "Kearsarge," and it is to him that I am indebted for the material which forms the subject of this article.

After the officers of the "Kearsarge" had rendered what assistance they could towards alleviating the distress caused by the earthquake, they turned their attention to the havoc wrought by the shock and tidal-wave. Prominent amidst the debris, and about a quarter of a mile from the shore, they found a number of so-called "mummies," which had been exposed by the receding tidal-wave. These Peruvian mummies are not mummies in the same sense that we speak of those of Egypt. The Egyptian mummies were preserved artificially from putrefaction by being embalmed, an art peculiar to the people of that country; but the Peruvian bodies are simply desiccated, the conditions of the atmosphere and soil being conducive to their preservation.

The mummies are usually found in vaults or chambers of adobe, roofed with sticks or canes and a layer of rushes; these usually contain several bodies, which are placed in a sitting posture, the chin resting on the knees, the hands being clasped around the knees. Sometimes the face rested on the hands, with the elbows crowded down between the thighs and abdomen. The bodies are wrapped in native cloths and bound with cords. A small thin piece of copper was usually placed in the mouth; this corresponded to the *ōbolos* which the ancient Greeks put into the mouths of their dead as a fee for Charon. They were accustomed to bury with them such utensils as they were supposed to need in the country to which they journeyed. The farmer had seeds of various kinds and agricultural implements placed about him; the fisherman had his net wrapped about him, and nearby fish-hooks were placed with barbs wonderfully like those in use at the present time. The wealthy had costly articles in pottery and precious metals buried with them, and it is on account of this custom that many graves have been opened with the expectation of finding valuables. The women had their spindles for spinning, and in some instances the last thing they did before leaving their work forever, as shown by the unfinished web of cloth placed about them. Flowers were found by Lieutenant Gardner as fresh to the eye as if plucked only a short time previous, but of course in a dried state.

Articles of the toilet were also found, such as mirrors, combs made of fish bones set in wood, and hollow bones of birds carefully plugged with cotton and filled with pigments of various colors, while close at hand was the swab used in applying them to the face. Rings were in some instances of the precious metals, but all those seen by Lieutenant Gardner were made of copper; he also found implements for sewing. The children were surrounded by toys of native make.

On account of their nearness to the shore and their surroundings, it is highly probable that the mummies seen by Lieutenant Gardner were those of fishermen and their families.

The most interesting thing about these mummies is the finding of the so-called "Incas eyes." These were of various sizes, corresponding to the age of the individual.

These eyes are of an oval outline, flattened at one end and made up of concentric layers deposited about a central point. They are brittle and quite iridescent. They were found in the orbit, being held in place by the cloth which was bound about the head. Lieutenant Gardner was not certain whether they were placed under the eyelid — the eye being removed — or were outside the lid. His impression was, that they were outside, as they fell out as soon as the cloths which bound the head were removed. I cannot find any reason why they were used.

At first, I thought the eyes were composed of some resinous substance, but as soon as I began to examine them critically, I found that my first impression was erroneous. After examining sections and fragments, softened by long immersion in glycerine, I came to the conclusion they were the crystalline lens of some animal.

The next point to decide was from what animal they were taken. A clue was given by the fact that fragments left in distilled water for a day or two under a dust-shade, developed an odor which I could compare to nothing but that of old bilge water. Although this was a very questionable clue, yet it led to the successful solution of the question.

If the eye of a cephalopod be removed and carefully opened, it will be found that the "anterior of the retinal chamber is occupied by a bi-convex lens divisible into a smaller outer and a larger semi-globular internal part, the two being separated by a membrane." The principle of the well-known Coddington lens is the same as that which enters into the formation of this eye. The posterior portion of this eye is the one made use of by the

[1] αὔξη, growth, and λόγος, science.

[2] See a paper entitled "The Terms of Auxology," by S. S. Buckman, F.G.S., and F. A. Bather, M.A., F.G.S., London, in the Zoölogischer Anzeiger, No. 405 and 406, p. 42', Nov. 14 and 28, 1892.

ancient Peruvians. The source of supply was doubtless from the squid or octopus, which are still found in abundance along the coast.

CURRENT NOTES ON ANTHROPOLOGY.—XXII.

[*Edited by D. G. Brinton, M.D., LL.D.*]

The Canstatt and Neanderthal Skulls.

EVEN in some very late treatises on archæology and ethnology I observe that there is still talk of the "race of Canstatt" and the "race of Neanderthal," these imaginary races of ancient Europe being supposed to be represented by the skulls found in those respective localities. The late M. de Quatrefages was, I believe, responsible for the erection of these skulls into "types," and for the theories of prehistoric ethnography based upon them.

It should be recognized, once for all, that there is no sort of foundation for these scientific dreams. In neither instance did the locality in which these skulls were found guarantee them any high antiquity. The Canstatt skull was unearthed along with Roman pottery, and in all probability belonged to the fourth or fifth century, A. D. The Neanderthal skull, on which still greater stress has been laid, and casts of which are to be seen in most archæological museums, was not dug up at all, but was picked up in a gully which had been washed in the mountain side, and came from dear knows where. Probably there had been an old graveyard further up the hill, but by no means one in quaternary times. The fragment, moreover, is so fragmentary, and presents such evident signs of pathologic processes, that it is more than daring to assume it as the typical cranium of any race.

These and many allied facts in the same direction were admirably brought out in a discussion last August at the meeting of the German Anthropological Association by such speakers as Von Holder, Virchow, Kollmann, and Fraas. Their arguments leave no room to doubt the unimportance of these remains.

Time-Reckoning of the Mayas.

A short but carefully studied article in a recent number of the *Globus* (Bd. 63, No. 2), by Dr. Förstemann, presents some striking facts showing the accuracy attained by the ancient Mayas of Yucatan in the calculation of time. His sources are the Dresden and other ancient codices, to the interpretation of which he has devoted fruitfully much study. The contents of the Dresden Codex is largely astronomical or astrological, several of its pages being comparisons of the relative times and positions of the heavenly bodies. It is clear that these sky-readers had ascertained that the mean synodical revolution of Venus is 584 days, which is correct to a very small fraction. They had fixed the revolution of Mercury at 115 days, and it is probable but not quite certain that they had rightly estimated the revolution of Mars at 780 days. Jupiter and Saturn they did not study, or, at least, take into these calculations.

Not less surprising was the accuracy they reached in measuring the lunar month. They had by their observations reduced it to 29.526 days. This is about five minutes in the month too short, as the true synodical revolution is 29.53 days. For this difference, intercalary days would be required at certain epochs.

It is probable from this that the Mayas were ahead of any other American stock in the measurement of time, exceeding even the Mexicans; though these also appear to have discovered the length of the year of Venus. Dr. Förstemann's discussion of the subject amounts to a demonstration, and merits the close attention of students of Maya civilization.

The Co-Existence of the Mammoth and Man.

Not long since, the distinguished and venerable archæologist, J. Steenstrup, of Copenhagen, published a paper examining the discoveries in Europe which are supposed to prove the contemporaneity of man with the mammoth; and reached the conclusion that not only is the evidence inadequate, but for climatic and geologic reasons no such co-existence was possible.

At the last meeting of the German Anthropological Association Professor Virchow quoted Steenstrup's conclusion and endorsed it, as did also others present. The "reindeer period" was the remotest to which they were willing to assign the appearance of man in Europe on existing evidence. The artefacts of mammoth teeth and bones found in the caves were asserted to be from fossil remains picked up by the cave men. Where such artefacts are found in gravels along with mammoth bones, they would say that these gravels are themselves posterior to the reindeer period, and hence contain objects of various preceding periods.

There remains for consideration the delineation of a mammoth on a bone from the Lena cave in the south of France. This was but discussed, being probably considered of questionable origin. In the United States two such delineations have been brought forward. They are both strikingly similar to this French original, which has long been made familiar to American readers through various publications. Both proceed from the valley of the Delaware River. One is on shell and one on stone. I have examined both originals very carefully, and apart from the vagueness which surrounds the finding of both, for purely technical reasons I believe both to be recent. There still lacks conclusive evidence that man and the mammoth were contemporaneous in the area of the United States.

Proposition for an Ethnographic Study of the White Race in the United States.

In preparing some lectures last winter on the ethnography of the United States, I was struck with the deficiency of trustworthy material on this subject. The Indians and the Negroes have received far more attention at the hands of ethnologists than the whites. It is high time that a systematic study be made of the latter, with a view to discover what influences the New World and its conditions have exerted on this race wholly foreign to its soil.

I would propose that a plan be adopted similar to that which has recently been outlined in Great Britain for an ethnographic survey of that kingdom. A joint committee has been appointed by the leading anthropological, antiquarian, and folk-lore societies to raise means and carry out details. A list of certain typical villages will be made in which there are at least a hundred adults whose ancestors are believed to have lived a number of generations in the district, and to have been subjected to a minimum outside influence. From this list the committee will select the most promising places, and will send a properly equipped student to record the following points:—

1. Physical type of the inhabitants by measurements, photographs, etc.
2. Peculiarities in dialect, local pronunciations, expressions, etc.
3. Local traditions and superstitions.
4. Old buildings, relics, and other antiquities.
5. Historical evidence and genealogies showing purity of race.

Such a plan could be most advantageously carried out in the United States. Suppose thirty students were selected, trained, and sent to pass their summer vacation in as many secluded villages in New England, the Middle States, and the oldest settled portions of the South, all pursuing their investigations on the same lines. We should receive a mass of the most valuable information by which to solve many most interesting and instructive ethnographic problems. One pleasant feature would be the very moderate expense for which this could be accomplished; for these secluded villages are precisely where one can live the cheapest in the whole country.

We could then compare the descendants of the middle class English who settled New England with those of the Scotch-Irish and Palatine Germans of Pennsylvania, with the French of South Carolina and Louisiana, the settlers of the mountains of Virginia and East Tennesse, the "crackers" of Georgia, and so on. Will not the active societies in the United States interested in these lines of research unite their efforts to realize some such project?

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RECENT OBSERVATIONS AT KILAUEA.

BY JOSIAH KEEP, MILLS COLLEGE, ALAMEDA CO., CAL.

The great volcano of Kilauea, on the island of Hawaii, like all other live things, is constantly changing, and any report of its condition is liable to need important corrections on the advent of the next steamer. The last great explosion, however, took place in 1790, more than a century ago, and since that time the huge pit has been filling up with black lava and the area of activity has been narrowing. During the month of July last I had an opportunity to observe the igneous action under exceptionally favorable circumstances, and a record of its condition at that time can hardly fail to be valuable for comparison with past and future reports.

The crater is a huge depression or pit, about three miles long and two miles broad. The walls are mostly precipitous, though quite irregular, and the floor is some three hundred feet below the surface of the island at that point. Forty years ago it was several hundred feet lower. Standing on the brink of the crater and looking down, one is reminded of a great cellar after a fire. Every thing is black or rusty, and the smoke and steam coming up from dark clefts put you in mind of the charred and smoking timbers to be seen after a conflagration. A zigzag path, a mile long, leads down through ferns and bushes to the black lava, and then you step out on a sea of absolute desolation. The lava is cold now, but there are the most abundant evidences of its recent fusion. The surface is greatly varied; here being nearly smooth, and there swelling up into steep hillocks, perhaps with caves beneath them, into which you can creep or perhaps walk upright. Cracks abound, and out of some of them the hot slag has oozed, and flowed, and cooled, and hardened.

After walking over two miles of this rough floor I came suddenly to the brink of a second pit in the floor of the greater one. This second pit, the "Halem' oum' ou" of the natives, is about half a mile in diameter, and at the time of my visit its floor was some two hundred and fifty feet below the point where I was standing. Some adventurous climbers descended the precipitous sides and actually stood on the freshly-cooled lava, but I did not accompany them. In the centre of this lower floor was the lake of moulten lava, nearly circular in outline, and about one thousand feet across. Its level surface was largely covered by a thin, gray crust, portions of which would often sink and reveal the glowing liquid beneath.

The fiery lake was never free from agitations, particularly around its edges, but the extent and violence of the activity were constantly changing. Occasionally a liquid hillock would rise like an enormous bubble, then sink back again, while a puff of thin, blue smoke would slowly rise and float off from the spot, showing that in a condensed state it had doubtless been the lifting agent. But most of the agitation resembled the lively boiling of a kettle of water over a brisk fire. The glowing fountains would jump and dance in the wildest manner, often throwing up the fiery drops to a height of fifty feet, while waves of lava would surge against the curb of the lake with a sound like that of ocean breakers. In the night time, seen through an opera glass, the display was beautiful and grand beyond description.

The continual falling of half-cooled drops of lava around the edge of the lake, combined with the wash of the fire-waves, serves to build up a curb, which grows in proportion to the activity of the lake. On one side of the pool of melted rock its top was some thirty feet higher than the floor which joined the base of the curb to the walls of the pit. One night the lava rose in the lake and poured over the curb on that side in a magnificent cascade of fire. It was not possible to get in front of the overflow, but it was estimated that the stream was fifty feet wide. The motion of the current was like that of a water cascade, but when the flood reached the floor of the pit it quickly began to congeal on the top, while the under part ran on till it reached the confining walls. Another overflow, where the curb was not so high, came directly towards my point of observation, and I could clearly see that the central point of the stream moved swiftest, causing the hardening waves to assume the well-known crescent forms.

By such overflows from the moulten lake the inner pit is being gradually filled up; in fact, its floor has risen several hundred feet the past few years. The lake rises *pari passu*, the curb never rising very high above the floor. What the result will be is uncertain. Should the lava continue to rise, the pit will soon be filled and will overflow into the basin of Kilauea itself. But instead of this the bottom of the pit may drop out, so to speak, as it did very suddenly before this last rise, and instead of gazing into a lake of fire the tourist may be compelled to look into a huge smoking hole, some five or six hundred feet deep. Doubtless the whole floor of Kilauea rests on a very hot foundation, as the steam which ascends from many cracks indicates, but at the time of my visit there was no melted lava visible except in the lake which I have described.

The questions presented by these phenomena are intensely interesting; but the more I observed the boiling of the lava, the more I became convinced that aqueous vapor is not the chief agent which does the work, though it may be concerned in starting the tremendous chemical action, perhaps a decomposition of sulphides, which I think is the source both of the heat and of the commotion.

EXTREMES IN THE PLANT WORLD.

BY PROF. J. I. D. HINDS, LEBANON, TENN.

Of living organisms, the largest, as well as the smallest, are found in the vegetable kingdom. In point of bulk, even the elephant compares unfavorably with the largest trees, and the smallest living objects, seen by the help of the microscope, are undoubtedly plants.

The largest plants known are what are popularly called "the big trees of California." They are conifers, belonging to the genus Sequoia, which is intermediate between the firs and cypresses. There are two species, *S. sempervirens* and *S. gigantea*. The former is the common redwood and abounds on the Coast Range from the southern part of California northward into Oregon. The latter is not so common, but grows to a larger size. "It is confined to the western portion of the great California range, occurring chiefly in detached groups, locally called 'groves,' at an altitude of from 4,000 to 5,000 feet above the sea." It grows to enormous size, varying in height from 200 to nearly 400 feet and in diameter from 20 to 30 feet. One tree in Calaveras County is 325 feet high and 45 feet in circumference six feet from the ground. Another measured 90 feet in girth and 321 in height. Some of these trees are supposed to be 3,000 years old. They were then in their vigor when the Roman Empire was at the height of its glory and hoary with age when Columbus landed on the American shore.

Let us now turn from these giants of the forest to those plants which can only be seen with the higher powers of the microscope. The smallest of these and at the same time the smallest of living things are the plants known as Bacteria. They have an average diameter of one twenty-five thousandth of an inch and a length

one to ten times as great. Many of them have a diameter of less than one fifty-thousandth of an inch and it is probable that there are multitudes of them so small that the highest powers of the microscope do not render them visible. Two thousand of them could swim side by side through the eye of a needle and one could hold in his single hand fifty millions of millions of them. Of the smaller ones it would take 15,625,000,000,000 to fill one cubic inch.

Now compare these with our mammoth Sequoias. The trunk of one of these trees, to say nothing about its roots and branches, contains at least 200,000,000 cubic inches. It is, therefore, 3,125,000,000,000,000,000,000 times as large as a single bacterium. This number is, of course, inconceivable. It may be read 3 125 millions of millions of millions. The proportion is about the same as that of an ordinary football to the earth itself.

Again, the duration of the life of many of the bacteria is only an hour. There are 8,760 hours in a year, and in 3,000 years there are 26,280,000 hours. Thus the tree has lived on while more than twenty-six millions of generations of its invisible kindred may have lived and died in the stream at its base. From the bacterium to the sequoia, what a span! Yet the rolling globe on which they live is but a speck in the universe, its diameter too small to be used as a measuring unit for interstellar spaces. As many bacteria could be laid side by side on a linear inch as earths upon the diameter of its orbit around the sun. Compared with the tree, the bacterium is almost infinitessimal; by the side of the earth, the tree is insignificant; in the solar system, the earth is but a small factor; and if the solar system were annihilated, it would be millions of years before its loss would be felt on distant stars. Magnitudes are, therefore, relative, and things are great or small according to the standpoint from which we view them.

Cumberland University.

DESTRUCTION OF CROWS DURING THE RECENT COLD SPELL.

BY DR. ROBERT RIDGWAY, SMITHSONIAN INSTITUTION, WASHINGTON, D.C.

WHETHER it be the result of disease or exposure, the suffering inflicted on the crows in the vicinity of Washington during the recent severe weather is of great extent, and of such a character as to excite the sympathy of any one familiar with the facts. On the 20th of January my son went rabbit hunting, and on his return told me he had found many dead crows in the pine woods, and others that were totally blind. The following day I accompanied him to the place where he had found them, and was really astonished at the sight presented. Very few crows were seen flying about, but upon entering the thick woods of scrub-pines, which was evidently the roosting-place of large numbers of these birds, they were met with on every hand. Some were lying on the snow, dead and frozen stiff; many more were perched in the trees, at various heights, in all stages of helplessness. The majority of them could fly, and on our near approach would do so; but in a moment it became apparent that they could not see, for the first thing in their line of flight, as, for example, a branch, would stop them, when they would either flutter to the ground or, changing their course, would continue their flight, to be again checked by a branch, or if they happened to miss any obstruction until clear of the woods (which rarely occurred) they continued, slowly feeling their way, over the open fields, often dropping to the snow-covered ground after flying a few hundred yards. Those which did not fly at our approach were too much weakened from starvation to do so. They were easily caught, and in every instance were found to be absolutely blind, except one individual, which had one eye but little affected. In many the eyes were closed and much swollen; in some one or both eyes had burst and frozen, this having possibly been caused by violent contact with the sharp ends of broken twigs. In all cases in which the eyes were not closed or inflamed the pupil was milky white and the iris bluish. Inability to find food on account of their blindness was evidently the immediate cause of starvation; for it was found that the dead birds were, as a rule, very much emaciated, while many of the living ones, particularly those which were most active, and consequently difficult to capture, were in fairly good condition. It was pitiful to behold their suffering, both from the pangs of hunger as well as from the pain of their wounded eyes. Sometimes the snow beneath the trees was nearly covered by pine needles and small twigs which they had plucked off and tried to eat (they were seen doing this), while several of those which had fallen to the ground were eating snow.

The extent to which this epidemic, or whatever it may be, has affected the crow population of this locality is not easy to estimate. My first impression was that the species was nearly exterminated there, since certainly 95 out of every 100 crows seen during the day were perfectly "stone-blind," and 10 per cent of them dead. That this impression was incorrect was, however, proven by the next day's observation, the locality being visited much later in the day, when large numbers were seen coming in from the surrounding country to roost, — all these "able-bodied" crows having been abroad after food at the time of our previous visit. There seemed to be about as many of these as there were of the disabled ones, so the reduction in their numbers will probably not exceed one-half, and may not be so great.

A third visit, several days later, showed no increase among the afflicted birds. There were, however, as might have been expected, a much larger number of dead ones, while those still living were found more scattered, being encountered nearly everywhere in the open fields, where they had fallen, exhausted, during their flight from the woods.

So far as I was able to discover, after very careful examination of all specimens within reach, during both visits, only the common species, *Corvus americanus*, was affected by the malady. At any rate, neither my companions nor myself could discover a single fish crow (*C. ossifragus*), though the latter was well represented among those which were flying about.

I am at a loss to account for this scourge. Several causes have been suggested, the most plausible of which, it seems to me, is that in returning to their roosting-place one excessively cold evening they were compelled to face a freezing wind, perhaps bearing minute ice-particles, which actually froze their eyes. It may be, however, that a better explanation can be given.

REMARKS ON AMERICAN LICHENOLOGY. — III.

BY W. W. CALKINS, CHICAGO, ILL.

THE explorers for lichens in a locality so favorable as Florida will not fail to notice the abundance of brilliantly colored fungi, and, if interested, will be tempted to collect them. On some of these will perhaps occur parasitic lichens of rarity, as *Colnogonium* and *Opegrapha*. But beneath a bed of *Agaraci*, on the sandy soil of an old plantation, a close search will show another interesting lichen, known as *Heppia despreauxii* Tuck. Its character was long disputed, owing to a close resemblance to an allied genus of lichens, *Solorina*. The small cup shaped apothecia, growing single or in clusters, immersed in a green thallus, have deceived good lichenists. We owe to Dr. Tuckerman the elucidation of this elegent species. Only two were described by him in the "Synopsis." Last winter I had the good fortune to find another in the mountains of Tennessee, which, having been sent in vain around our own country, a puzzle to all, was promptly determined by Dr. Nylander of Paris to be the *Heppia virescens*, *Ach. variety rugosa* Nyl. I may remark that it is astonishing how soon afterwards we all saw the point.

In the old field as well, with a mixed second growth of *Pinus taeda*, *Ilex opaca*, *Ilex Cassine*, *Myrica cerifera*, *Olea americana*, etc., will be found on their foliage numerous small fungi, such as *Sphaeria* and *Cercospora*, many of which have been illustrated by Professor Ellis in his "Exsiccati" from my collections of fungi.

In close contact, lichens and fresh-water algæ and *Hepaticæ* also hold equal sway. But, towering over all, the stately *Magnolia* and the *Gordonia* (red or bull bay), with their glossy evergreen foliage, afford us the tropical lichen, *Strigula complanata* Fee., and, rarer still, *Heterothecium augustini* Tuck., though, indeed, the *Sabal serrulata*, common everywhere, abounds in elegant specimens in

some localities. There are also on this prostrate palm most remarkable fungi, for which see Ellis. By the slow-running stream occur *Biatora hynophila*, on mossy substrates. Many terricoline lichens of rarity will reward a patient collector. I have often visited one locality, leaving it at last in the belief that nothing more could be found. However, still unsatisfied and impelled by something, I would return and find new prizes, as I soon learned from my teachers. I mention this to show that no researches in the field of nature can be wholly completed. I also offer it as an incentive to thorough work. Whilst lichens thrive almost everywhere in Florida, sometimes in very novel situations, the vicinity of the ocean is prolific of them. Even an old *Ostrea* shell has its peculiar *Verrucaria*; on old timber, *Xylographa*; while just inland, among dense thickets of *Ilex cassine*, revel *Arthonias* and *Graphis*. Here also the beautiful rosettes of the *Cladonia rangiferina* L., *variety alpestris* L. (which is *F. minor* of Michaux), cover the earth and are known to the uninitiated as mosses, — price to the winter tourist who searches for nature's gems in hotels twenty-five cents.

In open places the eye will often rest upon a carpet of the crimson-fruited *Cladonia leporina* Fr. and *C. pulchella* Schw. There are also other species of this genus, but less conspicuous on account of having brown fruit. On shrubs near the sea occur in abundance very fine specimens of *Ramalina rigida*, *variety montagnaei* Tuck. But we tire of conspicuous forms at last, and seeking the most difficult and least known, find them in *Arthonia* and *Graphis*. The following species are sufficient to show what may be expected in a field where investigations have been merely begun.

Arthonia albovirescens Nyl. A new species on *Ilex cassine* at Fort George, and on shrubs in tropical Florida. A good species (Nyl. Lich. N. G.) (*Bot. Bull.*, 1889). (*Syn. Arthonia* Willey.) Abundant.

Arthonia floridana Willey. A new species collected by me at Jacksonville on *Ilex* (*Syn. Arthonia* Willey). Rare.

Arthonia ochrospila Nyl. On *Myrica cerifera*, at Jacksonville. Also Cuba. Rare.

Arthonia gregarina Willey. On *Myrica* sparingly at Jacksonville and south. (*Syn. Arth.*)

Arthonia taedescens Nyl. A very fine and rare species on *Ilex cassine*, at Jacksonville and south. (*Syn. Arth.*)

Arthonia ochrodiscodes Nyl. A new species, *Ilicicola*. Fort George and southward. Described by Nylander in "Lichenes Japoniæ," page 107. Quite distinct. Abundant.

Arthonia platygraphidea Nyl. An elegant species I collected from Fort George south. Also Mexico.

Graphis adscribens Nyl (*Lich. N. Caled.*). Found by me on *Gordonia* and other trees, Jacksonville to tropical latitudes. Also in Mexico. Very fine.

Graphis nitidescens Nyl. Very minute, white, and hard to find. I have had several so named, all differing from the true one identified for me by Nylander. On *Liriodendron*, at Jacksonville and southward to Cape Sable (Tuckerman, Syn. Pt. II., page 123).

Among the new *Graphis* of Florida described by Nylander, I will only mention now *Gr. abaphoides*, *Gr. subparilis*, *Gr. subvirginalis*, *Gr. turbulenta*, all tropical or sub-tropical.

Platygrapha subattingens Nyl. A new species, *Supercorticem, Liriodendri*, at Jacksonville; southwards to Cuba. Described by Nylander in "Lichens N. G.," page 51. A very fine lichen (*Bot. Bull.*, 1889).

OSTEOLOGICAL NOTES.

BY DANIEL DENISON SLADE, MUSEUM OF COMPARATIVE ZOÖLOGY, CAMBRIDGE, MASS.

THE order of the Ungulata may at the present time be divided into the Ungulata vera, including therein the two sub-orders, Perissodactyla and Artiodactyla, and the Ungulata polydactyla, or Subungulata of Cope, which also comprises two sub-orders, Hyracoidea and Proboscidea.

In its morphology, the jugal arch of the Ungulata presents various modifications. With few exceptions, two bones only enter into its composition, the squamosal and jugal, which are connected by a suture, the general direction of which is horizontal. Both the horizontal and vertical curvatures of the arch present considerable variations, as does also its relation to the neighboring parts.

In the group Perissodactyla, the family Equidæ exhibits an arch, which, although relatively slender, is quite exceptional in its arrangement. The large and lengthened process of the squamosal not only joins the greatly developed post-orbital process of the frontal, but, passing beyond, forms a portion of the inferior and posterior boundary of the orbit. The malar, spreading largely upon the cheek, sends back a nearly horizontal process to join the under surface of the squamosal process above described, thus completing the arch, while the orbit is entirely surrounded by a conspicuous ring of bone, thereby clearly determining the bounds between it and the temporal fossa, which last is remarkably small. Moulded into this fossa, which is bounded above and posteriorly by more or less well-developed crests or ridges, is the temporal muscle. The pterygoids are slender and delicate, without the presence of any fossa. The glenoid surface is much extended transversely, concave from side to side, and bounded posteriorly by a prominent post-glenoid process. The angle of the jaw is much expanded. The condyle is much elevated above the molar series, while the coronoid process is long, narrow, and slightly recurved.

In the Rhinoceridæ and Tapiridæ the arch is strongly developed, and composed of the squamosal and jugal processes, which are joined at about its centre by an oblique suture from above downwards, backwards, and upwards. There is a small postorbital process, largest in the tapir, but the orbital and temporal fossæ are continuous. The surface for the temporal muscle is extensive. The glenoid fossa presents a transverse, convex surface to articulate with the corresponding one of the mandible, which is not much elevated above the dental series. The coronoid process is slender and recurved, while the angle is broad, compressed, somewhat rounded, and incurved.

In the Artiodactyla, the arch is slender, and is composed of the process from the jugal, which passes backwards beneath the corresponding forward projecting process of the squamosal, the juncture being by a suture nearly horizontal in direction, and longest in the Cervidæ. The jugal also sends up a postorbital process to meet the corresponding descending one of the frontal, the suture which unites them, being about midway. Thus the bony orbit is complete, while the jugal is forked posteriorly. The temporal region is relatively small. The horizontal curvature of the arch is very slight. The glenoid fossa is extensive and slightly convex, with a well-developed post-glenoid process. The pterygoids present a large surface and are situated nearer the middle line than is the case in the Perissodactyla. The condyle is broad and flat, and the coronoid process is long, compressed, and slightly recurved. The angle is rounded and much expanded.

The Tylopoda alone among the Ruminantia have large surfaces and accompanying crests and ridges for the increased development of the temporal muscles. The horizontal curvature of the arch is greater than in the true Ruminants, consequently the temporal fossa is wider and deeper — all in correlation with the powerful canine teeth. The forked articulation between the molar and the squamosal is also more strongly marked.

Among the non-Ruminantia, the family Suidæ, or true pigs, exhibit an arch in which the process of the jugal underlying the squamosal extends back to the glenoid fossa — the two bones being connected by a suture, which is vertical anteriorly for the depth of half the bone, and then horizontal. The post-orbital process does not meet the frontal; in fact, all traces of this are lost in Sus scrofa. In the Peccary and Barbaroussa it is quite prominent. The arch is short, and the vertical as well as horizontal curvatures are considerable. The narrow, transverse, condylar surface of the mandible, and the small coronoid process, with its rounded superior surface, are but slightly raised above the level of the alveolar surface. The pterygoid surface is extensive and the fossa deep.

In the Hippopotamidæ, the arch is broad and strong. Its superior border presents a marked sigmoid curvature, and the con-

vexity, which is always posterior, is in this case much shorter in proportion. The temporal fossa, as also the surface for the muscular insertions, are extensive. The pterygoid surface is not so large as in the Suidæ. The glenoid fossa is slightly concave, but not bounded externally by a continuation of the jugal. The condyles of the mandible are nearly on a level with the molars, and the coronoid process is small and recurved. The angle is greatly modified for muscular attachment.

In the Hyracoidea, the arch is composed of three bones, of which the jugal is the most important. Resting anteriorly upon the maxilla, the jugal sends backwards a process to form the external boundary of the glenoid fossa. It also sends upwards a post-orbital process to meet a corresponding one from the parietal alone or from the parietal and frontal combined, thus completing the bony orbit. Both horizontal and vertical curvatures are slight. The surface for the temporal muscle is largely developed, while the pterygoid fossæ are well marked. The ascending ramus of the mandible is high, and the angle is rounded and projects very much behind the condyle, which last is wide transversely, and rounded on its external border. The coronoid process is small, slightly recurved, and not on a level with the condylar surface.

In the Proboscidea, the arch is straight and slender and composed of three bones. The maxilla forms the interior portion, while the jugal, supported upon the process of the maxilla, meets that of the squamosal in the middle of the arch, and is continued under this as far as the posterior root. This modification is unlike that of any other ungulate. There is a small post-orbital process from the frontal. The temporal surface is extensive, and that of the pterygoid considerable. The ascending ramus of the mandible is high, and the condyle small and round. The coronoid process is compressed, and but little elevated above the molar series. The angle is thickened and rounded posteriorly.

As has previously been remarked in regard to other orders of the Mammalia, the modifications undergone by the jugal arch in the Ungulata are determined by the development of the masticatory muscles. In the Perissodactyla, for example, the sagittal crest, ridges, and extensive parietal surface are correlated with increased insertions of the temporal muscle, while the large, strong, and complicated arch have equal reference to a powerful masseter. So in the Artiodactyla, especially in the Ruminantia, the diminished surface for the temporal, and the smaller, weaker arch, both denote diminished energy in the above muscles, while the enlarged pterygoid muscular insertions show that the required action has been provided in another direction. As Professor Cope has shown, "Forms which move the lower jaw transversely have the temporal muscles inversely as the extent of the lateral excursions of the jaw. Hence these muscles have a diminished size in such forms as the Ruminants, and are widely separated."

The singular fact that the Tylopoda alone of the selenodont Artiodactyla possess the sagittal crest is explained by Professor Cope, by the presence of canine teeth, which are used as weapons of offence and defence, and which demand large development of the temporal muscles. Moreover, this group retains the primitive form of the molar series, which is below and posterior to the vertical line of the orbit, while in the Bovidæ it is anterior.

EARLY METHODS OF BORING.

BY JOSEPH D. MCGUIRE, SMITHSONIAN INSTITUTION, WASHINGTON, D. C.

IN the process of recent investigations at the National Museum into early methods of boring as practised by different races, the writer thought that the similarity existing between the Esquimaux toggle or two-handed strap-drill, and practically the same implement used by the ancient Greeks and Hindus, and also the resemblance between the bow-drill used by the early Egyptians and the same tool used by American Indians could not fail to interest those concerned in early methods of boring.

There is an Egyptian fresco in the Royal Museum of Berlin representing a workman with a bow-drill boring a hole in the bottom of a chair, and the only difference between the drill he is using and those in the National Museum collection, especially from the Eskimoan area, is that the Egyptian bow appears much longer than the same tool used by our Indians.[1]

There is much in a comparison of these drills that is of interest regarding the evolution of the implement and the possibility of independent invention. The toggle or two-handed drill consists of a shaft a foot or more in length, a head-piece or bearing of wood or ivory, with often a stone socket for the drill-shaft to revolve in at the top. This socket-piece is held by the one working it between his teeth, and thus kept in position. The shaft is revolved by means of a narrow strap of leather wrapped once around it. On the ends of the thong are tied pieces of wood or bone by which the operator pulls the strap alternately to the right and to the left, thereby revolving the drill, which by downward pressure on the socket-piece is prevented from slipping aside.

In the ninth book of the Odessey, Ulysses describes how he and his companions, imprisoned in a cave, bored out the eye of Polyphemus (Cowper's translation.)

"They grasping the sharp stake of olive wood,
Infixed it in his eye, myself advanced
To a superior stand, twirled it about.
As a shipwright with his wimble bores
Tough oaken timber, placed on either side
Below, his fellow artists strain the thong
Alternate, and the restless iron spins,
So, grasping hard the fire-pointed stake,
We twirl'd it in his eye; the bubbling blood
Boil'd round about the brand."

The bow-drill used by the Zuni and other American tribes is an immense improvement on the above, for the thong is attached to a bow worked with the right hand, and the head-piece is held by the left, thus saving the jar to the head and teeth, which with the toggle drill was considerable.

[1] Lepsius, Kong'l. Museum, Abtheil. der Aegypt. Alterthümer, Berlin, 1855, tafel x.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Confusion in Weights and Measures.

THE remarks of Professor W. P. Mason on "Confusion in Weights and Measures" in *Science* for Dec. 23, 1892, are interesting and timely. A few erroneous statements which they contain serve only to emphasize the fact that the system of weights and measures in customary use is so confusing, so unscientific, and, in some instances, apparently so contradictory that it is difficult to write of it, even briefly, without falling into error. It may be useful to the readers of *Science* to have some of these errors corrected and also to be furnished with a brief statement of the existing condition of the question of standards in the United States.

Professor Mason's difficulty in ascertaining the number of grains in a gallon of water at 60° F. is a very natural one, and one not likely to disappear in the near future. The United States gallon is a measure of capacity and not of mass. It contains 231 cubic inches. The mass of this volume of water at any given temperature can only be determined by experiment, and an accurate determination is exceedingly difficult. All results must be regarded as approximations, and variation among them means no more than variation among published values of other physical constants, which are determined by experiment, but can never be fixed by legislation. It has always been customary in the United States Office of Weights and Measures, as indeed it may be regarded as almost necessary, to adjust the volume of a capacity standard by ascertaining the mass of water which it will hold under certain conditions of temperature and pressure. But this is merely a matter of convenience; the gallon is by definition 231 cubic inches, and the bushel is 2150.42 cubic inches, and when it is desired to ascertain the mass of a gallon of water one must select that value of the density of water which one thinks the

most accurate. The latest determination of the mass of a cubic inch of water is that of Mr. H. J. Chaney, superintendent of weights and measures in London, which was communicated to the Royal Society on Feb. 4, 1890. Mr. Chaney ascertained the weight of water displaced by three bodies, which he designated respectively by the letters C, Q, and S They were:—

C, a platinized hollow bronze circular cylinder, 9 inches in diameter and height.

Q, a quartz cylinder, 3 inches in diameter and height.

S, a hollow 6-inch brass sphere.

With these he found as follows:—

In normal air a cubic inch of distilled water, freed from air, at the temperature of 62° F., was found to weigh—

C	252.267
S	252.301
Q	252.261

By normal air is meant "Air at $t = 62°$ F.; $p = 30$ inches, containing four volumes of carbonic-anhydride in every 10000 volumes of air, and also containing two-thirds of the amount of aqueous vapor contained in saturated air, weighed at Westminster, latitude 51° 29' 53"—at 16 feet above sea-level. A cubic-inch of such air weighs 0.3077 of a grain"

The International Bureau of Weights and Measures is engaged in the investigation of this constant, and when its conclusions are published the question will probably be definitely disposed of for a long time to come.

The Troughton 82-inch scale was formerly accepted as a standard of length, but for many years it has not been actually so regarded. By reason of its faulty construction it is entirely unsuitable for a standard, and for a long time it has been of historic interest only. Since its rejection as a standard the United States yard has been considered as identical with the imperial yard of Great Britain, the material representations of which are two accurate copies, made and presented to the United States at the time of the adoption of the imperial yard.

The standard of mass has been the avoirdupois pound, identical with the imperial pound of Great Britain, except for purposes of coinage, for which the standard is the Mint Troy pound, brought from London in 1827, and which was legalized for this purpose by Act of May 19, 1828, and re-enacted in the year 1873.

As, with a single notable exception to be referred to later, this is the only legislation by Congress upon the subject of standards, it is important to inquire by what authority the standards above mentioned exist as such. Professor Mason has indirectly answered this. Congress having failed to take advantage of its constitutional privilege of establishing a uniform system of weights and measures, it became necessary to provide standards for the executive departments, by means of which taxes and revenues could be determined and collected. As the Treasury Department was mostly concerned in these matters, the question of standards was left to it. To the first superintendent of the Coast Survey, Mr. Ferdinand Hassler, was committed the task of constructing standards having the necessary degree of precision, and he was made superintendent of the Office of Weights and Measures. The Troughton scale was brought to this country by him early in this century. A part of it was selected as the standard yard. In the absence of legislation, it will be seen that the standards of the United States Government were those approved as such by the secretary of the Treasury, on the recommendation of the superintendent of Weights and Measures. In the mean time, it was known that there was great lack of uniformity among the various States. To encourage such uniformity Congress, in 1836, authorized the construction of copies of the various standards used in the Treasury Department, to be distributed to the governors of the several States. This action was taken by the Office of Weights and Measures, and did much to bring about uniformity. At once many, and finally nearly all, of the States made these copies their standards, and thus practical uniformity was secured. Theoretically or rigorously, however, there are about as many systems of weights and measures in use to-day as there are States in the Union. There are cases, indeed, in which no legislation whatever has taken place, and, while there are severe penalties for the use of false measures, there is nothing to fix what measures are true, except, of course, as custom or common law controls.

The additional national legislation referred to above is the Act of 1866, by which the metric system was legalized over the whole country. This is interesting and important as being the one single bit of general statute upon the subject of weights and measures.

In 1875 the International Metric Bureau was organized. To it practically all civilized nations are now contributors. Its object was to construct and distribute prototype standards of the metre and kilogramme to the various contributing nations. These standards were completed and distributed about three years ago. The seals upon the standards for the United States, metre No. 27 and kilogramme No. 20, were broken by Benjamin Harrison, president of the United States, on Jan. 2, 1890, in the presence of James G Blaine, the Secretary of State, William Windom, the Secretary of the Treasury, and a number of gentlemen distinguished in the various professions in which precision in measurement is highly regarded.

They have thus been accepted as standards of the first authority in this country, second only to the International prototype metre and kilogramme of the International Bureau at Paris.

The metric system having thus received the recognition of the only general legislation by Congress and of executive approval, it has been determined that both the necessities of practical operations in weighing and measuring and the demands of precise metrology will be best met by referring the units of the customary system to those of the infinitely more perfect and rapidly becoming universal system based on the metre and the kilogramme. The relations of the respective units are now so accurately known that this may be done with an approximation entirely satisfactory.

Fortunately the law of 1866, in its table of equivalents, is based on these relations as then known, and later investigations have only tended to confirm the value of the yard in metres as there defined. Thus the wisest course is also the easiest, and the yard and pound, as known in the Office of Weights and Measures, are now defined as a certain part of a metre and a kilogramme, respectively.

These definitions are as follows:—

1 yard $= \frac{3600}{3937}$ metre.

1 pound = 0.453597 kilogramme, according to the statute of 1866.

Or more accurately—

1 English pound = .4535924277 kilogramme.

These two values differ by approximately one part in one hundred thousand. T. C. MENDENHALL.

Office of Weights and Measures, Washington, D.C.

Easy Method of Calculating Complex Surveys.

A METHOD of calculation employed by Mr. L. M. Graham, manager of the McLean Co. Coal Co., of this place, is new to me, and may be useful, or at least interesting, to some of your readers. In the payment of royalties on coal mined, many exceedingly complicated underground surveys must be made, the computations of which are very difficult. Having made on a piece of tracing paper a plat of the survey, in all its windings, he transfers this plat to a piece of cardboard; and then cuts away the cardboard, making an opening the exact form of the plat. The cardboard containing this opening is then attached to a smooth surface as a back. As a measure, he has made in cardboard an opening one inch wide and several inches long; and down the edge of this has marked a scale; one square inch representing one hundred square feet. Taking very fine shot, he fills with this the opening in the cardboard representing the plat, taking pains to see that the shot lie but one deep; then pours these out into the measure; and readily makes his estimate. The manager says the plan was thought out by himself; and if a similar plan has been used elsewhere, he has not known of it. It strikes me as being ingenious, and widely applicable to complicated surveys, whether below or above ground. R. O. GRAHAM.

Bloomington, Ills., Jan. 25.

Notes on Several Special Transformations.

WHILE reciprocating and subtracting from unity both belong to the periodic transformations whose period is two, yet the two combined lead to a transformation whose period is six. It is of special interest to observe that the six values thus obtained are the six related values of an anharmonic ratio. They are the following:—

$$a, \quad \frac{1}{a}, \quad \frac{a-1}{a}, \quad \frac{a}{a-1}, \quad \frac{1}{1-a}, \quad 1-a.$$

This furnishes a convenient means of remembering these important values.

In the special case of homographic transformations, when

$$x = \frac{ay - a_2}{a_3 y - a}$$

we easily see that is expressed in the same form with respect to x as x is with respect to y. That is

$$y = \frac{ax - a_2}{a_3 x - a}$$

When x and y are reals the locus of this equation is symmetrical with respect to the bisector of the angle between the x and y axes. GEO. A. MILLER.

Eureka College, Jan. 26.

Skeletons of Steller's Sea-Cow Preserved in the Various Museums.

IN the last number of *Science* (Feb. 3, 1893, p. 56) Dr. Barton W. Evermann has an interesting note on the "Skeleton of Steller's Sea-Cow," which he was fortunate enough to purchase for the National Museum during his stay at Bering Island, 1892. The article is slightly erroneous where he enumerates the material in the museums previous to his visit to the island, as many more skeletons and parts of skeletons are preserved than he thinks.

He says: "This [i.e., the skeleton in the U. S. National Museum, made up from bones brought home by me], together with the two skeletons at St. Petersburg and Helsingfors, and the two ribs in the British Museum, constitute the total amount of material pertaining to Rytina found in the museums of the world at the time of my visit to Bering Island."

Let me add to this that there is a fairly good skeleton in the museum of the Swedish Academy of Sciences at Stockholm, brought home by Nordenskiöld, and figured by him in his famous account of the "Vega" expedition. Another "nearly perfect" skeleton is in the British Museum, described and figured by Henry Woodward in the Quarterly Journal of the Geological Society (London, August, 1885, pp. 457–472). A third skeleton of *Rytina gigas*, and, in some respects at least, the best one, is in the museum of the Academy of Sciences in San Francisco, where it was mounted during the early part of 1893. This skeleton was formerly part of the museum belonging to the Alaska Commercial Company, but was afterwards presented to the Academy. As I said, this skeleton is in some respects superior to any one thus far found, although the cranium mounted with it belongs to another specimen. It was found on Bering Island during the winter of 1881–82, and as the cranium was not in as good condition as the rest of the skeleton a better one was substituted. I acquired the original, which is among the many crania which I collected for the National Museum.

These are the three entire skeletons of which I have any record, but there are undoubtedly several others in various museums. If I am not mistaken, St. Petersburg has acquired additional material (recently the Museum there offered a skull in exchange), and so have the museums in Moskva, Odessa, and, above others, Warshaw, to which city Dybowski sent most of the material collected by him. It is also reasonable to suppose that he reserved some for the universsty in Lemberg.

I myself collected about 20 crania for the National Museum besides quite a number of isolated bones in addition to those which were used in the "made-up" skeleton. Some of this material has been distributed to the various museums, if I am not mistaken.

It will thus be seen that "the total amount of material pertaining to Rytina found in the museums of the world" is considerably larger than the three skeletons and two ribs mentioned by Dr. Evermann. LEONHARD STEJNEGER.

U. S. National Museum, Smithsonian Institution, Washington, D.C., Feb. 7.

"Unconscious Cerebration."

SOME very puzzling psychological phenomena may be explained in simple ways by happening upon the correct point of view.

Numerous theories have been afloat to account for recollections of what had apparently never been seen before. For example, a friend of mine came across a scene in the Yellowstone, on his first visit to that region, and was astounded at the familiarity of every detail upon that occasion.

Knowing that he was addicted to fits of abstraction, I suggested that while preoccupied he had unconsciously mentally registered his surroundings and soon thereafter, without being aware of so doing, compared a conscious impression with an unconscious one.

A convincing illustration in common experience is afforded all of us when we are carefully reading a book and suddenly become aware of having turned a page or even several pages while thinking of something else all the time, and when we turn back and begin again are surprised to find that every word is familiar to us, though the reading over again was necessary to supply what otherwise might have been a gap in memory.

There may be other causes for similar instances, but the above will satisfactorily explain some cases, and simple explanations are preferable to far-fetched ones. S. V. CLEVENGER.

Chicago, Ill.

BOOK-REVIEWS.

Hereditary Genius: An Inquiry into Its Laws and Consequences. By FRANCIS GALTON, F.R.S., etc. London and New York, Macmillan & Co. 379 p. 8°. $2.50.

Finger Prints. By FRANCIS GALTON, F.R.S. London and New York, Macmillan & Co. 216 p. 8°. $2.

THE first edition of Galton's "Hereditary Genius" appeared as long ago as 1869, and that before us is the second. His observations excited considerable attention, for, although he dealt with familiar facts for the most part, his methods of analyzing and stating them were new, and the results which he arrived at were not merely unexpected, to an English public they were startling.

These results are by no means modified to a feebler expression in the present edition. A few examples will illustrate this. On page 133 he says, "I look upon the peerage as a disastrous institution, owing to its destructive effects on our valuable races." Of the Christian Church in earlier centuries he writes: "She brutalized human nature by her system of celibacy, and demoralized it by her system of persecution of the intelligent, the sincere, and the free." Nor does he allow that she is much better to-day. She keeps us "in antagonism with the essential requirements of advancing civilization," and "leads us to a dual life of barren religious sentimentalism and gross materialistic habitudes."

These severe arraignments are not the hasty attacks of a polemist, but the calm reflections of a mature student of social statistics and historic data. If they shock any one by their force, he should study the volume, and ask himself whether they are not amply justified by the array of evidence it contains. The title, "Hereditary Genius," falls singularly short of the real scope of the work. It is, in fact, a comprehensive study of the means of improving the human race through wiser arrangements for reproduction. The precepts it inculcates will convince as well as surprise the reader, and many an ancient saw is pricked and disappears like a bubble by the keen points of the author's reasoning.

Mr. Galton's "Finger Prints" is a volume made up of various essays and observations, which have engaged him for several years, on the external anatomy of the papillary ridges on the extremities of the thumb and fingers. He has found that they remain singularly individual in character through long periods of life, and thus may serve for purposes of identification. They are slightly hereditary and have little or no ethnic value. They do not appear to be correlated to mental ability, temperament, or character. The volume as a whole presents an admirable model of a closely scientific investigation of a somatologic point; and perhaps is as valuable in this respect as for any definite results reached.

The Foot-Path Way. By BRADFORD TORREY. Boston, Houghton, Mifflin, & Co.

STUDENTS of living things have not inaptly been divided into two general classes, naturalists and biologists; the former including Englishmen like Gilbert White, Thomas Edward, and Richard Jefferies, and Americans like Thoreau, Burroughs, and Bradford Torrey, who delight in studying the actions of living beings on their native heath, in the coppice beside the brook, or amid the silence of the forest. Among the biologists are found the great majority of modern students whose days are spent in the laboratory, and who care little for a living organism until it has been killed, dissected, frozen, and cut into infinitesimal slices by the microtome. Without attempting to discuss the relative merits of these two methods, it will readily be admitted that the naturalists can put into their writings much more of that humanitarian interest which gives the charm to literature. Readers of Mr. Bradford Torrey's "Birds in the Bush" and "A Rambler's Lease" will know what to expect in wandering with him along the present "Foot-Path Way." They are not likely to be disappointed. Besides glimpses of rare warblers and individual peculiarities of common birds, they will now and then see a beautiful landscape, or hear the murmur of a mountain brook, while mingled with all they will find much delightful philosophy. They will go to beautiful Franconia in June to learn

"How good life is at its best! And in such
'charmed days,
When the genius of God doth flow,'

what care we for science or the objects of science.—for grosbeak or crossbill (may the birds forgive me!) or the latest novelties in willows? I am often where fine music is played, and never without being interested; as men say, I am pleased. But at the twentieth time, it may be, something touches my ears, and I hear the music within the music; and, for the hour, I am at heaven's gate. So it is with our appreciation of natural beauty. We are always in its presence, but only on rare occasions are our eyes annointed to see it."

Besides June in Franconia, there are papers on December Out-of-Doors, Dyer's Hollow, Five Days on Mount Mansfield, A Widow and Twins, A Male Ruby-Throat, Robin Roosts, The Passing of the Birds, A Great Blue Heron, Flowers and Folks and the Weymouth Pine. The humming-bird sketches (A Widow and Twins and A Male Ruby-Throat) are peculiarly interesting, while those on The Robin Roosts and The Passing of the Birds are full of fascinating bird news.

The Testimony of Tradition. By DAVID MACRITCHIE. London, Kegan Paul, Trench, Trübner, & Co. 204 p. Illustrated.

THE writer of this volume attempts to show that the ancient Picts of Scotland were of Mongolian descent, and had come across the sea from Norway. That, so far as we know, there never were any Finns in Norway about Bergen, whence the "Finmen" are said to have come, does not trouble Mr. MacRitchie. He merely remarks that "it may be assumed" that there were (p. 35). He lays much stress on the skin boats which these early seafarers used. But the Welsh used also just such, as well as many other nations. He makes no attempt to trace any of the ancient Pictish names to Finnish radicals, though he hints that it could be done.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Feb. 4.—R. S. Woodward, Abstract and Discussion of Paper Read at Last Meeting; F. L. O Wadsworth, Method of Determination of the Metre in Terms of a Wave-Length of Light; Waldeman Lindgren, Two Neocene Rivers of California; H. W. Turner, Remarks on the Geology of Calaveras County, California.

The Finns, Lapps, and Eskimos, he teaches, belong to the same race — a surprising piece of information, which can scarcely also be "assumed." Still more extraordinary is the discovery, which is wholly new and wholly his own, that the colony of Swedes who settled on the Delaware River in the seventeenth century were not Swedes at all, but "Swedish Finns," and that they introduced among the Pennsylvanian colonists "plainly an infusion of unadulterated Eskimo blood!" (p. 36). This will be a startling bit of news to those worthy Philadelphians who take so much pride in their genealogies reaching back before the landing of Penn.

Seriously, the very slender basis for the whole theory is the syllable *Fin*, the same that occurs in "Fenian," "Fingal," etc., and which has evidently started the author in pursuit of this Mongolian *ignis fatuus*.

Criminology By ARTHUR MACDONALD. With an Introduction by Dr. Cesare Lombroso. New York, Funk & Wagnalls Company. 416 p. 8°.

THE brief introduction by Dr. Lombroso (only three pages) is a defence of his favorite theory of the criminal "type," by which he means "the organicity of crime, its anatomical nature, and degenerative source." This notion was distinctly rejected by the criminal anthropologists assembled last summer in Brussels, and it is encouraging to note that this fact was not lost on Mr. MacDonald, for he tells us in his preface that "the 'type' has been considered from the psychological rather than the physical side." This is virtually giving up the position of Lombroso, which, in fact, is no longer defensible. There is absolutely no fixed correlation between anatomical structure and crime, so far as has yet been shown.

In his text, the author draws largely from well-known writers, as Lombroso, Ferri, and Corre, though he is also by no means deficient in facts from his own observation. He begins with a study of the evolution of crime, proceeds to discuss the physical and psychical sides of the criminal, his intelligence, and his associations. Criminal contagion, hypnotism, and relapse furnish topics for other chapters. Special studies of murder, theft, and meanness follow, and the volume closes with a copious and excellent "Bibliography of Crime," and a satisfactory index. The work may be recommended to all who would take up the study of this attractive and practical branch of anthropology.

Bible Studies. By HENRY WARD BEECHER. Edited by John R. Howard. New York, Fords, Howard, and Hulbert. 438 p. 8°. $1 50.

The Evolution of Christianity. By M. J. SAVAGE. Boston, G. H. Ellis. 178 p. 8°.

THESE volumes may appropriately be placed together. Both acknowledge as their main aim the widening of the religious concepts of modern Christianity, the teaching a broader, a more liberal, and more charitable construction of the tenets and the dogmas of protestant theology.

The "Bible Studies" begins with a chapter on the right understanding of the inspiration of the Bible, and follows with a series of readings and familiar comments upon them, extending from Genesis to Ruth. Beecher's admirable command of the English language needs no praise, and is well illustrated in these talks; and his position as a theologian is familiar to all American readers. Many of the passages in this book, however, sounded better than they read; they are in such colloquial style that they look frivolous.

Mr. Savage's notion of the evolution of Christianity is that it may finally evolve out of Christianity. He betrays some doubt whether it will even be called Christianity. But he is convinced that all that is best and truest in it, the love of neighbor and the faith in God, will be preserved; and that the conflict of religion with science, with free investigation and free speech, will cease. We can only say, "Soon be that day and quickly come that hour."

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange. — I have a few copies of my translation of "Strasburger's Manual of Vegetable Histology, 1887," now out of print, which I will send post-paid for $3 or for one dozen good slides illustrating plant or animal structure. Address A. B. Hervey, St. Lawrence University, Canton, N. Y.

The undersigned has the following specimens to exchange for crystals of any eastern or foreign localities or Indian relics: tin ore, metacinnabarite, stibnite, garnierite, calenanite, hanksite, ulexite, rubellite, lepidolite, blue and green onyx, Cal. pineite, aragonite on chalcedony, cinnabar, double refracting spar, clear and clouded, and others. J. R. Bush, care of General Delivery, Los Angeles, Cal.

For sale or exchange.—A private cabinet of about 200 species of fossils, well distributed geologically and geographically. Silurian, about 40; Devonian, about 50; Carboniferous, about 80; others, about 30. Frank S. Aby, State University, Iowa City, Ia.

For exchange.—Minerals, fossils, F. W. shells, land shells, native woods, Indian relics, two vols. of Smithsonian reports, odd numbers of scientific magazines, copper cents, etc., for good minerals not in my collection, good arrow- and spear-heads and natural history specimens of all kinds. Correspondence solicited with list of duplicates. G. E. Wells, Manhattan, Kan.

For sale or suitable exchange.—A spectrometer made by Fauth & Co., Washington, D. C., according to the plan of Prof. C. A. Young. This instrument is suitable for the most advanced investigations and determinations. Cost originally $700 and has been used but little. Will be disposed of at a considerable reduction. Address Department of Physics, Ohio University, Athens, O.

I will send British land and fresh-water shells in return for those of America, any part, sent to me. I have at present about fifty or sixty species, with many varieties. W. A. Gain, Tuxford, Newark, England.

The Biological Department of Hamline University desires to offer microscopic slides of animal tissues, or whole animals, in exchange for first-class fossils. Address correspondence to Henry L. Osborne, Hamline University, Hamline, Minn.

Kindly mention "Science" in writing to Advertisers.

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WANTED — Second-hand. Foster's Physiology, Balfour's Comparative Embryology, Claus & Sedgwick's Zoology, Flower's Osteology of Mammalia, Vine's Physiology of Plants. Please state editions and prices asked and address Richard Lees Brampton, Ontario, Canada.

WANTED.—American Journal of Conchology, seven volumes. Parties having these for sale will please address the undersigned, stating condition and price. R. Ellsworth Call, Louisville, Ky.

A GRADUATE ENGINEER will give instruction evenings in geometry, trigonometry and surveying, mechanics, physics, mechanical drawing and general engineering construction. Five years' experience in field and editorial work on engineering journal. References furnished. C. S. H., 102 Tribune Building, New York.

WANTED.—By well-qualified and experienced science master and associate of the Royal School of Mines, London, aged 26 (at present in England), a mastership in technical college or university for any of the following subjects: Engineering sciences, geology and mineralogy, physics, chemistry and metallurgy, etc., etc. Can provide excellent references and credentials. Apply, J. G., 17 Sussex St., Rochdale, England.

A GRADUATE of the University of Pennsylvania and a practical mineralogist of twenty years' experience desires to give his services and a cabinet of 25,000 specimens, all named, with about the same number of duplicates, in minerals, crystals, rocks, gems, fossils, shells, archæological and ethnological specimens and woods to any institution desiring a fine outfit for study. The owner will increase the cabinet to 50,000 specimens in two years and will act as curator. Correspondence solicited from any scientific institution. J. W. Horttar, M.D., Ph.D., San Francisco, Cal., General P. O. Delivery.

TO THOSE INTERESTED IN SCIENCE.

[Science (weekly) established in 1883, N. D. C. HODGES, 874 Broadway, New York City.]

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Agriculture, Experimental, Status of.
Amenhotep, King, the tomb of.
Anatomy, The Teaching of, to Advanced Medical Students.
Anthropology, Current Notes on.
Architectural Exhibition in Brooklyn.
Arsenical Poisoning from Domestic Fabrics.
Artesian Wells in Iowa.
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Gems, Artificial, Detection of.
Glacial Phenomena in Northeastern New York.
Grasses, Homoptera Injurious to.
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